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BUTTERFLIES OF GREAT AND LITTLE INAGUA, BAHAMAS

HARRY K. CLENCH†

Associate Curator, Section of Insects and Spiders

KAREN A. BJORNDALE¹

ABSTRACT

Thirty-four species of butterflies have been recorded from Great Inagua, and nineteen from Little Inagua, southern Bahamas. The collecting history is outlined, geography and habitats described, and zoogeography discussed. These arid islands have a depauperate fauna, only occasionally successfully colonized by Hispaniolan species. In the southern Bahamas as a whole (including the Turks and Caicos islands), endemism is relatively high. The 34 species from the Inaguas are listed with records of occurrence, notes on behavior, habitat preference, adult food plants, and taxonomic remarks. A new subspecies of *Epargyreus zestos* (Hesperidae) is described.

INTRODUCTION

Even to Bahamians, the Inaguas are a long way off. Transportation to and from the islands is relatively infrequent; tourist attractions and visitors are few. Not surprisingly, the butterflies of these islands have remained little known. Published references to Great Inagua butterflies are few and material in collections has been scanty; until March 1976 no butterflies had ever been collected on Little Inagua at all.

Quite independently each of us has acquired a substantial amount of information about the butterflies of these two islands. Also quite independently we had each intended to write an account of them.

† d. 1 April 1979.

¹ Address: Department of Zoology, University of Florida, Gainesville, Florida 32611. Submitted for publication 30 August 1979.

When we learned of our common interest and intentions, we decided to combine our efforts, and the present paper is the result.

HISTORICAL NOTES

So far as we are aware, Charles J. Maynard was the first person to collect butterflies on Great Inagua. He visited the island only once, in 1888 (Turner, 1957:144), and apparently took some butterflies there. No specimens survive, and the only hint of this is in his paper (Maynard, 1889), in which he mentions having examined specimens of *Agraulis* [*vanillae*] *insularis* from "New Providence, Andros, Rum Key, and Inagua, Bahamas."

Twenty years later, in February and March 1909, W. W. Worthington spent several weeks on Great Inagua, mostly at Alfred Sound and Matthew Town (Todd and Worthington, 1911). He was engaged primarily in collecting birds, but he also made a representative collection of butterflies (CM). A list of the eighteen species he took may be of interest: *Danaus plexippus*; *Precis evarete*; *Precis genoveva*; *Anartia jatrophae*; *Euptoieta hegesia*; *Agraulis vanillae*; *Strymon martialis*; *Strymon columella*; *Leptotes cassius*; *Hemiargus thomasi*; *Kricogonia lyside*; *Eurema elathea*; *Eurema chamberlaini*; *Ephyriades brunnea*; *Ephyriades zephodes*; *Hylephila phyleus*; *Wallengrenia* sp.; *Panoquina panoquinoides*.

Over twenty years later, in January 1932 and 25 to 27 February 1934 (Barbour and Shreve, 1935:349), the Armour Expeditions stopped at Great Inagua and collected a total of 10 species (MCZ). The Inagua lycanids of these expeditions were included in Clench (1943).

In late January and early February 1953—another twenty years had elapsed—the Van Voast-American Museum of Natural History Expedition visited Matthew Town (Rabb and Hayden, 1957:21, 26–28). They apparently spent little time collecting butterflies, as they took only three species (AMNH), listed by Rindge (1955).

Twenty years once again were to pass before the next collection. In late November and early December 1973, H. Clench (accompanied by Mary H. Clench) spent a week at Matthew Town, Great Inagua, taking 22 species (CM).

In 1974—the "twenty year interval" had finally been broken—the Hayes family stopped briefly at Matthew Town during a summer cruise through the Bahamas and took six species (CM).

K. Bjørndal lived for a year and a half on Great Inagua, from April 1975 through August 1976. Most of her time was devoted to work on her doctoral thesis subject, the nutritional ecology and energy budget of the Green Turtle, *Chelonia mydas*. She was able, nonetheless, to make an extensive collection of butterflies, totalling 27 species (CM), accompanied by observations on their habits and habitats.

The Carnegie Museum Bahamas Expedition stopped at Matthew Town in March 1976, and Clench made a further collection of 16 species (CM). Unfortunately, each of us was unaware of the other's presence on the island at the time, and we did not meet. The butterflies of this expedition were listed by Clench (1977*b*). In April 1977, Clench again spent a few days in the vicinity of Matthew Town, taking 24 species (CM).

Bjorndal made a brief second visit to the island in June 1978, taking 22 species. In all, now, about a thousand specimens of butterflies have been collected on Great Inagua, representing 34 species.

Butterfly collecting on Little Inagua has had a much briefer history. The first butterflies were taken there by Clench on the Carnegie Museum Bahamas Expedition in March 1976. Thirteen species were taken (CM), and two more seen. The expedition spent a day at Southwest Point, then moved to Northwest Point for another day of collecting, and a third day was devoted to a hike in to the Royal Palm Sink Holes.

A few months later, in July, Bjorndal also visited Little Inagua, spending most of her time on the southern coast, from Southwest Point eastward about 8 km. Her time was occupied with thesis work but she nonetheless was able to collect four species (CM), and saw an additional five.

In April 1977 Clench made a second visit to Little Inagua, taking 15 species and seeing at least one more.

For Little Inagua, now, a total of 240 specimens has been taken, representing 17 species, with two additional species known only from sight records.

GENERAL GEOGRAPHY AND HABITATS

Great Inagua

Geography.—Great Inagua (Fig. 1) is the southernmost island in the Bahamas. It lies only about 90 km northeast of the eastern end of Cuba, and barely more than that north of the western part of Hispaniola. Some 64 by 32 km, and with an area of 1,500 square km, it is the second largest island in the Bahamas chain. Deep water surrounds it on all sides, and the nearest islands, with the exception of Little Inagua, are West Caicos in the Caicos Islands about 60 km northeast, Acklins Island about 130 km northwest, and Mayaguana about 110 km north of Northeast Point (but only about 80 km from Little Inagua). Great Inagua is mostly low-lying and flat, with occasional widely scattered hills (the highest about 40 m), and entirely composed of limestone. In its middle is a large, shallow, salt lake, variously called Lake Rosa, Lake Windsor, or simply "The Lake." Depending on rainfall it can cover up to a quarter of the island. At the western end of the lake

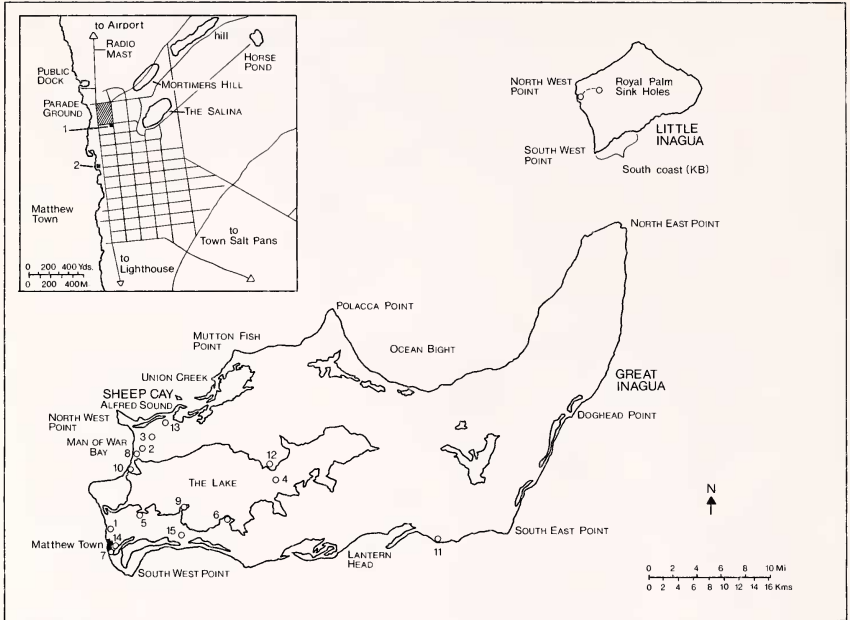


Fig. 1.—Map of Great and Little Inagua, showing localities mentioned in the text. Drawn by Nancy J. Perkins. Numbered localities on the main map are as follows: 1) Airport and Airport Ponds; 2) Blakes Well and Leather Fern Pond; 3) Calf Pond; 4) Flamingo Camp (Long Cay); 5) Georges Hill; 6) John Grey Hill; 7) Lighthouse; 8) Man of War Bay; 9) Maroon Hill; 10) Pump Station; 11) Rocky Point; 12) Spoonbill Ponds; 13) Stew Duck Pond; 14) Town Salt Pans; 15) Salt Pond Hill. Numbered places on inset map of Matthew Town are (1) Ford's Inagua Inn and (2) General store.

the Morton Salt Company (Morton Bahamas Ltd.) operates a solar salt industry. It is the economic mainstay of the island, harvesting up to a million tons of sea salt a year.

Fresh water on Great Inagua is scarce, limited to a few shallow ponds and sink holes in the northwestern quadrant, and to a small area called Horse Pond, near Matthew Town. Precipitation is slight, the reason for the xeric nature of the island. At Matthew Town the mean annual total is 28 in (71 cm), with three annual maxima—a small one in January, a larger one in May, and the largest in October (Anonymous, 1976:36). Rainfall in recent decades has been below average. In early 1978, however, it was uncommonly high, perhaps heralding a period of increased moisture.

Habitats.—The extent to which humans and feral animals have altered the natural vegetation is not known. The entire human population, about a thousand people in 1975, now lives in Matthew Town,

on the west coast. In the past at least five other communities were located along this coast, the people living by subsistence farming and fishing. A few similar communities were also present in the eastern and northern part of the island (Klingel, 1942). Today, small houses in various stages of decay and small, still flourishing patches of introduced ornamentals mark the locations of these deserted towns.

Farming has decreased over the past several decades, partly because of decreased rainfall, but more importantly because alternative employment is now available in the solar salt industry. As a result of this operation, extensive reservoirs and crystallizing pans have been built, and the area of hypersaline habitat has increased. Timbering on the island was limited to select cutting of *Lignum Vitae* (*Guaiacum sanctum*) in coppices, but this ceased over thirty years ago. Populations, reputedly large, of feral donkeys, goats, hogs, and cattle are present, and they have undoubtedly altered the natural vegetation to some extent.

The major habitat types can be enumerated under two headings—open areas, and wooded areas.

1. Open areas: the vegetation is sparse or low, not over 1 m high, and often less than 0.5 m.

1. Town lots (Matthew Town). The ground is usually rocky, with sparse soil in pockets, and a variety of low herbaceous vegetation, including grasses, forbs, and others, generally kept low by cutting or grazing by goats, and with peripheral or occasional tall ornamental shrubs of various kinds. Although this is a highly and continually disturbed habitat, for some reason a number of species of butterflies on Inagua are found only here (except for occasional strays), where they are resident and fairly common—*Eurema lisa*, *Eurema elathea*, *Hemiargus ceraunus*, *Pyrgus oileus* (the latter common in 1973, but not seen since). Also common, but found elsewhere too, are *Phoebis senae* (commoner in town than elsewhere), *Phoebis agarithe*, *Euptoieta hegesia*, and *Agraulis vanillae*.

2. Dry meadows. Grasses up to 0.6 m, moderately dense, with a variety of low flowers, particularly *Stachytarpheta*. These meadows are usually small (typically 6 to 15 m on a side) and seem to be man-made. They occur almost always along roads, and the *Stachytarpheta* is usually most dense along the road edge. It is a curious habitat type, but conspicuous and with numerous butterflies (notably, in some, *Wal-lengrenia* sp.).

3. Moist meadows. Sandy or loamy soil, with dense, tall (to 1 m) grasses alternating with dense low stands of *Phyla nodiflora* and other low forbs. This type was seen only at Horse Pond, a former fresh water pond (Todd and Worthington, 1911). Fresh but sulphurous water now lies about 1 m below the surface except for a few small pools.

The area is rich in butterflies, and several kinds have been found only, or chiefly, here—*Junonia evarete*, *Anartia jatrophae*, and *Strymon limenia*.

4. Salinas, and other hypersaline areas. As butterfly habitats these comprise level, salt-encrusted mud, subject to occasional inundation and evaporation, found about the borders of salt lakes or ponds. Vegetation is sparse and scattered, but includes the grass *Sporobolus virginicus* (growing in nearly pure, sometimes large, stands), *Salicornia virginica*, and *Batis maritima*. Around the landward edges of such places are usually found the prostrate *Sesuvium portulacastrum*, and often *Borrchia arborescens*, both of which are much used as food flowers by butterflies. Black Mangrove (*Avicennia germinans*) is usually present in the area. The most typical butterflies of such places are *Brephidium exilis* (rarely found anywhere else), *Panoquina panoquinoides* (a little more broadly tolerant), and *Ascia monuste* (relatively wide-ranging, but often commonest here).

II. Wooded areas. Vegetation includes a large percentage of woody species, at least in part taller than 1 m.

5. Upper strand. Along sandy beaches of protected shores, the upper strand is commonly marked by a band of flowering shrubs, among them *Suriana maritima* and *Mallotonia gnaphalodes*. These are particularly attractive to the lycaenids, *Strymon martialis*, *Strymon columella*, *Hemiargus thomasi*, as well as to *Junonia evarete*, *Agraulis vanillae*, *Wallengrenia* sp., and occasionally others.

6. Open scrub. Low, sparse vegetation less than 1.5 m high, this often represents areas formerly of dense scrub that have been bulldozed within the past 30 years or so and are slowly recovering. Such places usually contain relatively high populations of butterflies, among them *Euptoieta hegesia*, *Agraulis vanillae*, *Phoebis sennae*, and *Phoebis agarithe*.

7. Dense scrub. A dense, sometimes thorny, rather variable type, the major vegetation cover of the island. It ranges from 1.6 to 2 m in height, with occasional emergents, and is composed of a variety of broadleaved shrubs. The lower kinds of dense scrub are also a little more open, the higher phases denser and nearly impenetrable. Butterflies include *Anaea verticordia*, *Eurema chamberlaini*, *Hemiargus thomasi*, *Kricogonia lyside*, and *Ephyriades brunnea*.

8. Parkland. Low trees (to 6 m), rather widely spaced, with a sparse shrub layer. Local (notably surrounding Horse Pond) and of small areal extent, it supports few butterflies, most of them probably transient.

9. Coppice or hardwood forest. This is another vegetation type of limited occurrence. It is a low forest (to 6 m), with a closed canopy

and sparse ground level vegetation. Butterflies are few (among them, *Ephyriades brunnea* and *Papilio andraemon*).

10. Mangrove swamps. These comprise dense stands of *Rhizophora mangle*, along protected shores and sandy coasts. Common butterflies include *Kricogonia lyside* and *Epargyreus zestos*.

Little Inagua

Geography.—Although it is only about 10 km from Great Inagua (just north of Northeast Point), Little Inagua is nonetheless on a separate bank, and the water between the two islands is over 180 m deep. Little Inagua is small (about 127 square km) and compact. Along the western coast is a low, sandy "coastal plain"—rarely more than 100 m wide. Along the inner border of this plain is a low rocky scarp about 5 m high. Thence inward the surface is more or less level, highly eroded rock. In the interior are a few low ridges, and an occasional knoll reaches 30 m elevation.

To judge from the vegetation, precipitation on the island is slight, averaging perhaps 20 to 25 in (50 to 63 cm) annually. The only fresh water we know of is that contained in the Royal Palm Sink Holes in the interior. These remarkable sink holes, certainly one of the most striking features of the island, comprise a chain of three or four holes, the major one about 10 by 20 m, and roughly 5 to 8 m deep. The surface rock overhangs part of this hole, and under the overhang is a pool of fresh water. Most of the remaining bottom of this hole is mud and leaf litter, with a dense stand of Sawgrass (*Cladium jamaicense*), a Mahogany (*Swietenia mahogani*), Wild Coffee (*Psychotria ligustrifolia*), and five large and one immature Hispaniolan Royal Palms (*Roystonea hispaniolana*). The largest of the royals we estimated to be about 25 m high, not only emergent but towering far above the surrounding vegetation. One could see it from several kilometers away by climbing occasional emergent trees. These are the only known native royal palms in the Bahamas, and were discovered from the air in 1973 by George Avery. Early in 1975 Donald Buden first reached them on foot and obtained a sample of their fruit, which confirmed their identity. Since then, a number of people have visited the sink holes, including both of us. Gillis et al. (1975) and Gillis (1977a, 1977b) have well described the discovery of these palms.

Alteration of habitats by man or feral animals has been minimal. According to older inhabitants of Great Inagua, when the part of that island near Northeast Point was inhabited, the residents sometimes crossed to the eastern end of Little Inagua and farmed there. This is no longer true, but from accounts the eastern end of the island would be worth visiting and may have habitat types not found elsewhere on

the island. With the exception of this former limited seasonal farming, the island has always been uninhabited. At the Royal Palm Sink Holes evidence of early man was particularly looked for, and none was found—no artifacts, no trace of soot on the rock overhang of the main sink hole, nor any other sign of former human presence. Feral donkeys occur on the island. We heard their braying frequently, mostly in the vicinity of the salina at Northwest Point, where they have worn a distinct path around the salt pond; we saw their droppings; and partly followed their trails through the scrub. These signs decreased inland and around the sink holes we saw no evidence of them. Their effect on the island and its vegetation is at most barely visible. Feral pigs and goats are rumored to occur, but we saw no evidence of them ourselves.

Habitats.—The habitat types on Little Inagua, so far as we know them, are similar to those on Great Inagua, but are fewer.

Salinas (no. 4 above) are common at frequent intervals all around the coast. They are like those on Great Inagua, and have the same butterflies.

Upper strand vegetation (no. 5) is widely distributed along the western coast at least and has the same butterflies except that no *Junonia* has been seen. *Strymon martialis* is particularly common.

Open scrub (no. 6) is well represented, especially near Northwest Point.

Dense scrub (no. 7) is the major vegetation component on the island, but has few butterflies inland—occasional *Ephyriades brunnea*, *Eurema chamberlaini*, and *Hemiargus thomasi*. Along the western coast it is richer and higher, and has more butterflies.

Coppice (no. 9) we found in only one place: on the sandy coastal plain about 1 to 2 km south of Northwest Point. Trees reach heights of 5 to 6 m, with a closed, or nearly closed, canopy. Here only, *Anaea verticordia* and a still undetermined species of *Papilio* (most likely *andraemon*) were seen, and here *Eurema chamberlaini* was more frequent than anywhere else on the island (but still not common).

The Royal Palm Sink Holes make a special habitat (described above), not seen elsewhere on Little Inagua, or anywhere on Great Inagua. Few butterflies were present, however. A few *Ephyriades brunnea* were visiting the flowers of *Psychotria* in the hole, and a single *Phoebis sennae* flew overhead. No other butterflies were noted.

LIST OF PLANTS MENTIONED

To save repetition in the species list we enumerate and briefly describe here the various plants mentioned. The heights we give are typical, not extreme. When common names are specific, they are capitalized; otherwise not.

Amyris elemifera (Rutaceae). Torchwood. A shrub (to 2 or 3 m), rarely a tree, found in

dense scrub. A known larval foodplant of *Papilio aristodemus* in Florida, and could be so on Great Inagua.

Avicennia germinans [formerly *A. nitida*] (Verbenaceae or Avicenniaceae). Black Mangrove. A tall tree (to 20 m or so), of protected inlets and hypersaline places, flowering in April–May, some into June.

Batis maritima (Batidaceae). Saltwort. A low (to 0.5 m) forb of open hypersaline areas.

Bidens alva var. *radiata* [formerly *B. pilosa* var. *radiata*] (Compositae). Beggars Ticks or Spanish Needles. A low (to 1 m), sometimes shrub-like forb of disturbed open areas. The white, few-rayed flowers are attractive to many butterflies. Flowers continuously, with a peak in mid-February to late March.

Borrhchia arborescens (Compositae). A forb (to 1 m) of the drier parts of hypersaline areas, its yellow flowers much visited by butterflies.

Cakile lanceolata (Cruciferae). Sea Rocket. A low (to 0.3 m, sometimes higher) forb of beaches and borders of hypersaline areas, flowering from December to May.

Casuarina litorea [considered by some to be *C. equisetifolia*] (Casuarinaceae). Australian Pine. A tall (to 10 m), pine-like tree, introduced and now naturalized, growing mostly near the coast, usually just back of the upper strand.

Catharanthus [formerly *Vinca*] *roseus* (Apocynaceae). periwinkle. A low (to 0.4 m) forb with showy white to pink flowers, attractive to a number of mostly large butterflies. It is not native but is extensively cultivated and has escaped often from cultivation. It blooms continuously.

Coccoloba uvifera (Polygonaceae). Sea Grape. A shrub or low tree (to 4 m), its clusters of small white flowers attractive to many different butterflies. Flowers from December to April, occasionally at other times.

Coccothrinax. See *Thrinax*.

Galactia spiciformis (Leguminosae). milk pea. A vine (to 1 m or more, on other plants) with small, purplish, pea-like flowers in clusters. Flowers from late October to April.

Guaiacum sanctum (Zygophyllaceae). Lignum Vitae. A tall (to 10 m) tree with blue flowers (February–June); usually found in coppice.

Jasminum fluminense (Oleaceae). jasmine. A vine with rather small white flowers; flowers in March to June, at least.

Lippia. See *Phyla*.

Mallotonia [formerly *Tournefortia*] *gnaphalodes* (Boraginaceae). Sea Lavender. A shrub (to 2 m) of the upper strand, with grayish green leaves and small white flowers in compact, elongate heads, attractive to many small butterflies. Flowers from November to March, and into April on Little Inagua.

Opuntia nashii (Cactaceae). prickly pear. An arborescent prickly pear, the pads borne aloft (to 2–2.5 m) on a trunk-like stalk, its showy, deep purplish pink flowers attractive to some (large) butterflies. It is rather local in open, arid scrub and flowers all year.

Opuntia dillenii (Cactaceae). prickly pear. Flowers from April to June.

Passiflora pectinata (Passifloraceae). passion flower. A vine.

Phyla [formerly *Lippia*] *nodiflora* (Verbenaceae). Capeweed or Fog Fruit. A low (to 0.4 m) forb of moist (fresh or perhaps brackish water) low places, often in dense colonies. The tiny white flowers in heads are attractive to many butterflies and the plant is in flower continuously. It is also the larval foodplant of a number of Nymphalidae.

Plumeria obtusa var. *obtusa* [formerly *P. inaguense*] (Apocynaceae). Frangipani. A shrub (to 2 m), found in dense scrub; flowers from March to July.

Psychotria ligustrifolia (Rubiaceae). wild coffee. A shrub (to 2 m) of relatively moist, shaded habitats. Its white flowers, appearing in March, are attractive to some butterflies.

- Rhachicallis americana* (Rubiaceae). Sandfly Bush. Flowers from March to July.
- Rhizophora mangle* (Rhizophoraceae). Red Mangrove. A shrub or low tree (to 3 m), with aerial, much-branched roots, of protected sandy or muddy shores. Flowers all year, with a summer peak.
- Roystonea hispaniolana* (Palmae). Hispaniolan Royal Palm. Native royal palm growing (to 25 m) in sink holes in the interior of Little Inagua.
- Sabal palmetto* (Palmae). Sabal Palm. Fan palm growing (to 4 m) in places with fresh water (at least subsurface) available. Flowers in April and May.
- Salicornia virginica* [formerly *S. perennis*] (Chenopodiaceae). Perennial Glasswort. A low (to 0.4 m) forb of open hypersaline areas.
- Sesuvium portulacastrum* (Aizoaceae). Sea Purslane. A spreading, prostrate vine with red stems and small, lavender-pink flowers, growing on sand beaches and at the borders of hypersaline areas. Its flowers are much visited by *Brephidium* and *Panoquina*, often by *Eurema chamberlaini* as well. Flowers more or less continuously.
- Sporobolus virginicus* (Graminae). dropseed. A low (to 0.4 m) grass of beaches and especially of hypersaline areas, often in dense clumps or even large meadows. Probable larval foodplant of *Panoquina*.
- Stachytarpheta* [formerly *Valerianoides*] *jamaicensis* (Verbenaceae). Blue Porterweed, Blue Vervain. A low (to 0.4 m), spreading weedy forb of disturbed open areas, especially roadsides. The small blue flowers are a major food source of many butterflies, especially Hesperidae. Blooms continuously.
- Suriana maritima* (Simaroubaceae). Bay Cedar. A shrub (to 2 m) of the upper strand. The small yellow flowers, scattered deeply among the close, numerous, small leaves, are attractive to a number of butterflies, especially Lycaenidae. Flowers especially from December to May; occasional individuals may be in flower any time.
- Thrinax morrisii* and/or *Coccothrinax inaguensis* (Palmae). fan palms. Small, to 2 or 3 m.
- Tournefortia*. See *Mallotonia*.
- Urechites lutea* var. *sericea* (Apocynaceae). Wild Allemanda. Flowers from February to June, with a secondary flowering in August–November.
- Valerianoides*. See *Stachytarpheta*.
- Vinca*. See *Catharanthus*.
- Zizyphus taylori* (Rhamnaceae). Zizyphus. A shrub (to 3 m), flowering chiefly in spring (March–April).

ZOOGEOGRAPHY

The aridity of the Inaguas seems to have played an important role in determining their butterfly fauna. Great Inagua has only 34 known species, instead of the roughly 48 that would be expected of an island of its size in the Bahamas. Similarly, Little Inagua has only 19 known species, instead of an expected 25. A few additional species are likely to be discovered on both islands, but it is doubtful that their totals ever will exceed about 80% of the "expected" values.

By virtue of its geographic position, Great Inagua should be an important port-of-entry island for butterflies dispersing to the Bahamas, particularly from Hispaniola. Relatively few species have used it, however. Andros is the primary port-of-entry for species coming into the Bahamas from Cuba (Clench, 1977a), and of its 60 known species, 31 (52%) can be assigned a Cuban origin. Only seven of the 34 species on

Great Inagua can be assigned a Hispaniolan origin, about 21%. (Some unassigned species on both islands have such a wide distribution and lack of local differentiation that they leave no clue to their source.)

Two of the Hispaniolan species on Great Inagua, *Pyrgus oileus* and *Ephyriades zephodes*, hint at a possible explanation. Both of these species may now be extinct on Inagua. Of the second, only a single specimen is known, taken in 1909. The first species was not uncommon in Matthew Town in 1973, but has not been found since. They suggest that species may reach Inagua from Hispaniola, perhaps with some regularity, and that under favorable conditions some of them may survive for several generations. Sooner or later, however, they generally become extinct, and the most reasonable explanation is aridity. Having lost their toe-hold in the Bahamas, of course, they cannot go on to other islands.

The Turks and Caicos Islands are also situated appropriately to function as a port-of-entry, but they are farther from Hispaniola (160 to 190 km, compared with 110 km for Great Inagua), and therefore may have been less effective.

These faunas are all so depauperate, and the interchange of species between the Caicos Islands and the Inaguas has been so great, that it is difficult to judge which island group has been the more important entry point. Once a species succeeds in reaching either of them it is most likely to proceed to the other. The exceptions are so few they tell us little.

Three species are known from Inagua, but not the Turks and Caicos. Two of them may now be extinct (*P. oileus*, *E. zephodes*); the third is *Eurema lisa euterpe*.

Two species are known from the Turks and Caicos, but not Inagua. One of them (*Euphyes singularis insolata* Butler, 1878) may be extinct—it is known from a single old specimen in CM from Grand Turk. Clench visited that island in January 1978, and made a particular point of looking for the butterfly, but none was found. The other species is *Strymon acis* subspecies. This undescribed subspecies is distinctly related to the Hispaniolan *S. acis petioni* Comstock and Huntington, 1943, not to *S. acis armouri* Clench, 1943, found in the more northern Bahamas (and in turn related to the Cuban *S. acis casasi* Comstock and Huntington, 1943).

Some of the Inagua species have reached there from the more northern Bahamas (and ultimately from Cuba). One of these, *Papilio aristodemus bjorndalae*, is not known from the Turks and Caicos (but it is extremely rare and could have been missed). The latter islands also have a single species of northern origin (*Electrostrymon angelia dowi* Clench, 1941) not known from the Inaguas. Another species, *Urbanus proteus domingo* Scudder, 1872, occurs on the Caicos Islands, but not

Table 1.—*Species of butterflies endemic to the southern Bahamas.*

Species	Islands				
	Great Inagua	Little Inagua	Caicos	Turks	Other
<i>Anaea verticordia intermedia</i>	X	X	X	X	—
<i>Hemiargus thomasi</i> ssp. (note 1)	X	X	X	X	X
<i>Eurema chamberlaini</i> (note 2)	A	A	B	—	C
<i>Papilio aristodemus bjoerndalae</i>	X	—	—	—	—
<i>Epagyreuus z. inaguarum</i>	X	X	X	—	—
<i>Ephyriades brunnea</i> ssp. (note 3)	X	X	X	X	X
<i>Wallengrenia</i> sp. (note 4)	X	X	X	X	X

Note 1. This undescribed subspecies of *thomasi* possibly occurs also on San Salvador.

Note 2. The capital letters each refer to different, endemic subspecies of *E. chamberlaini* (A = *inaguae*; B = undescribed; C = several other subspecies, in the more northern Bahamas as far as Eleuthera and New Providence).

Note 3. This undescribed subspecies of *E. brunnea* also occurs on Crooked and Acklins islands and on Rum Cay. The species is recorded from Mayaguana, but specimens have not been critically studied. They are probably also of this subspecies.

Note 4. This undescribed species of *Wallengrenia* is known also from Acklins Island and doubtfully from San Salvador.

the Inaguas. It may have reached the Caicos group from the more northern Bahamas, but because it also occurs on Hispaniola this is not certain.

The evidence, then, slightly favors faunal movement, in both directions, along this path: northern Bahamas—Caicos Islands—Inaguas—Hispaniola. Other routes have been used, but not quite to the same extent.

Endemism on the Inaguas themselves is relatively low, evidently because of the rapid and frequent exchange between them and the Caicos group. If we extend the field to the southern Bahamas, however, the degree of endemism is rather high. Table 1 gives a list of southern Bahama endemics. Several of these endemic taxa are quite distinct (especially *P. aristodemus bjoerndalae*, *A. verticordia intermedia*, and the *Wallengrenia*). Their distinctness strongly suggests that they persisted through the Wisconsin glacial period in these islands, or possibly on one or more of the now submerged Silver, Mouchoir, and Navidad banks, north of Hispaniola, which were emergent during the Wisconsin.

In resumé, the Inaguas share much of their depauperate butterfly fauna with the Caicos Islands. The two island groups have functioned as ports-of-entry for Hispaniolan species entering the Bahamas, with Inagua perhaps slightly more effective than the Caicos, but immigration from Hispaniola throughout has been weak. This is probably be-

cause of the islands' aridity, which seems to be the cause of their depauperate faunas as well. Nonetheless, the relatively high endemism in the southern Bahamas suggests persistence of some elements of the fauna through the Wisconsin glaciation, followed by a northward spread of some of them to more northern islands. A southward spread to these southern islands of some species of the more northern Bahamas has occurred also, but it seems to have been more recent, and a little less important to the Inagua fauna than the Hispaniolan elements.

SPECIES LIST

In the following list we refer under each species to Riley (1975), an indispensable publication to anyone working on West Indian butterflies. Other references are given only when they relate directly to Inagua.

The conventions in locality records are as follows. The months of flight are given in lower case roman numerals. Unadorned, they refer to actual captures; in brackets to sightings unsupported by specimens. Spans of months, as "ii-vi," means that the species has been taken in every month of the span (or sighted, in the case of bracketed spans). Sources of records are abbreviated as follows:

A 32, A 34: Armour Expeditions, 1932, 1934. In MCZ.

B 75, B 76, B 78: Bjorndal, respectively 1975-1976 (Great Inagua), 1976 (Little Inagua), and 1978 (Great Inagua). In CM.

C 73, C 76, C 77: Clench, 1973, 1976, 1977. In CM.

H: Hayes family, 1974. In CM.

L: David Campbell and Karen Lowell, 1976. In CM.

V: Van Voast-AMNH Expedition, 1953. In AMNH.

W: Worthington, 1909. In CM.

Other abbreviations include: up, upperside; un, underside; fw, fore wing; hw, hind wing; and these in combination, as unfw, uphw; pm, postmedian; st, subterminal. Institutional abbreviations are: AMNH, American Museum of Natural History (New York); CM, Carnegie Museum of Natural History; MCZ, Museum of Comparative Zoology (Harvard University, Cambridge, Mass.).

Family Danaidae

Danaus (Danaus) plexippus megalippe Hübner, 1826

Danaus plexippus megalippe: Riley, 1975:33, pl. 1 fig. 1.

Great Inagua (iii-iv, ix, [x-xii]).—Matthew Town (W); Man of War Bay; Union Creek (both B 75).

Little Inagua.—none seen.

Scarce. This species is usually seen singly, in open scrub and along the coastal strand. Only the non-migratory form is represented.

Danaus (Anosia) gilippus berenice Cramer, 1779

Danaus gilippus berenice: Riley, 1975:34, pl. 1 fig. 3b.

Great Inagua (iv, vi, vii, [viii]).—Matthew Town, Salina (C 77); Airport; Maroon Hill (both B 75).

Little Inagua.—not seen.

Usually uncommon, perhaps erratic in appearance, and seems to be quite local. Clench's April 1977 specimens, five males, were all taken feeding at flowers about 1 to 1.5 m above the ground, in a small area of scrub, grass, and flowers near the northwestern edge of the Salina, and the species was seen nowhere else at that time.

This population is best referred to subspecies *berenice* (Cuba, Cayman Islands, more northern Bahamas, southeastern United States), but an appreciable percentage of the individuals shows traces of traits characteristic of the Hispaniolan subspecies, *cleothera* Godart 1819 (Riley, 1975, pl. 1 fig. 3a)—variable loss of the white pm spots upfw below Cu_1 ; and paler, brighter ground color uphw and unhw. A small series from several of the Caicos Islands is quite similar to these.

Family Apaturidae

Anaea verticordia intermedia Witt, 1972

Anaea intermedia: Riley, 1975:60, pl. 4 fig. 10.

Great Inagua (iii, iv, vi–viii, xi, xii [seen all other months]).—Lighthouse (C 73); Matthew Town, including town proper, Salina, and elsewhere (C 73); Horse Pond (C 73, C 77); Town Salt Pans; Man of War Bay; Union Creek (all B 75); Stew Duck Pond (B 78).

Little Inagua.—1 mi S of Northwest Point, 9–10.iv (C 77).

Usually moderately common on Great Inagua, but numbers vary considerably. It flies mainly 1 to 1.5 m above the ground and perches on shrub branches. We have not seen it feed at flowers. The usual adult food seems to be leaking (perhaps fermented) sap at occasional, widely scattered, shrubs. At times a dozen or more may cluster about such a place, and the same site remains attractive for days at a time (at least). Individuals have been seen also at an old apple core on the ground, and *intermedia* may use other non-floral adult foods as well.

On Little Inagua its habits were slightly different. It was less common, and local in a low forest on the coastal plain (the only true forest on the island, so far as we have seen), mostly flying about a relatively tall tree and perching on its trunk, perhaps 4 to 5 m above the ground.

In the Turks and Caicos Islands this subspecies is not uncommon (Grand Turk, in fact, is the type locality), and specimens from these islands are only slightly separable in appearance from those of Great Inagua. In feeding habits, however, they are surprisingly different. Turks and Caicos individuals were never seen to visit non-floral foods.

They fed infrequently, but only at the small, pink flowers of a common shrub (*Lantana* sp.) in the dense scrub. Feeding at flowers was seen on all the islands where the species was found (Grand Turk, Providenciales, and North Caicos). Rarely they were seen in concentrations; these were always comprised of just a few individuals and did not involve feeding at all.

This form heretofore (Witt, 1972; Riley, 1975) has been viewed as a full species. It may be better considered (Clench, manuscript) a subspecies of the Hispaniolan *verticordia* Hübner, 1824, along with the Cuban *echemus* Doubleday, Westwood, and Hewitson, 1850, and it may be a stabilized hybrid product of both.

Family Nymphalidae

***Junonia evarete zonalis* C. & R. Felder, 1867**

Junonia evarete zonalis: Munroe, 1951:9 (in part); Riley, 1975:74, pl. 8 fig. 5 (in part; the figure represents *evarete michaelési*).

Great Inagua (ii, ii-iv, [v-viii], xii).—Matthew Town (W, C 77); Horse Pond (C 73); Man of War Bay (B 75).

Little Inagua.—not seen.

Uncommon, usually singly, and somewhat erratic in appearance. The species is found in coastal open scrub and also grasslands, often even in areas of dry grass and bare ground. It feeds at low flowers, notably those of *Stachytarpheta*. One or more *evarete* can usually be seen flying over the grassy meadow at Horse Pond.

***Junonia genoveva* [subspecies] Cramer, 1780**

Junonia evarete zonalis: Munroe, 1951:9 (in part); Riley, 1975:74 (in part, but not the figure).

Great Inagua (ii, vi).—Matthew Town; Alfred Sound (both W); Maroon Hill; Northwest Point (both B 78).

Little Inagua.—not seen.

Worthington obtained a respectable series (6 ♂, 8 ♀) in 1909, but only in 1978 have additional specimens been found. The species is known from other, more or less southerly, islands in the Bahamas (San Salvador; Rum Cay; Conception Id.). Bjorndal saw a species of *Junonia* by the hundreds on 26 July 1976 around the dikes of the Morton reservoirs. They might have been *genoveva*, but no specimens were taken and we cannot be certain.

This form is usually treated (Munroe 1951; Riley 1975; and others) as a dry season form of *evarete*, but the two are actually different species (Clench, manuscript). Forbes's (1928) mention of "*Junonia lavinia zonalis*" from Great Inagua was based, apparently, both on this series and on the two *evarete* that Worthington also took.

Anartia jatrophae saturata Staudinger, 1884

Anartia jatrophae saturata: Riley, 1975:75, pl. 7 fig. 5; Clench 1977b:276.

Great Inagua (ii, iv, vi).—Alfred Sound (W); Airport (B 75) and Airport Pond (B 78); Horse Pond (C 76, C 77); Matthew Town (W).

Little Inagua.—not seen.

Local and at times common. Near Matthew Town it is consistently present at Horse Pond, and Worthington's specimen, although labelled simply "Matthew Town," probably came from there. He knew the place well (Todd and Worthington, 1911). *A. jatrophae* flies low, lands often, and although wary it is not difficult to capture. It is usually found in moist, open depressions where its probable foodplant, *Phylla nodiflora*, grows in dense, low stands. Such places are not common on Great Inagua, and have not been seen anywhere on Little Inagua.

This population, and the one that occurs in the town of Kew on North Caicos (Caicos Islands), both belong to the Hispaniolan subspecies. Farther north in the Bahamas occurs the Cuban subspecies, *guantanamo* Munroe 1942.

Euptoieta claudia Cramer, 1776

Euptoieta claudia: Riley, 1975:84, pl. 8 fig. 8.

Great Inagua.—Union Creek, 22.ix.1975 and 7.x.1975; Man of War Bay, 14.x.1975, (all Bjorndal) (3 specimens).

Little Inagua.—not seen.

A new—and unexpected—discovery on the island. The specimens were found in coastal and open scrub. *E. claudia* flies with, and rather closely resembles, the common *Euptoieta hegesia*, so it is possible that other individuals have been seen and not recognized.

This species until recently was unknown in the Bahamas. It was not listed by Sharpe (1900), Rindge (1952, 1955), or West (1966); Riley (1975) makes no mention of it occurring in the Bahamas. The first known Bahama specimens were taken by David Hall on Grand Bahama in 1970. Since then *claudia* has been found on Great Abaco, North Andros, and even New Providence (Clench, 1977a:185; 1977b:276). The present record is the first from the southern Bahamas.

Euptoieta hegesia hegesia Cramer, 1779

Euptoieta hegesia hegesia: Rindge, 1955:7; Riley, 1975:83, pl. 8 fig. 7; Clench, 1977b:276.

Great Inagua (i–iv, [v], vi, vii, [viii], ix–xii).—Town Salt Pans (B 75); Matthew Town (W, V, C 73, B 75, B 78, C 76, C 77); Airport (B 75, L); Man of War Bay (B 75); Alfred Sound (W); Union Creek (B 75, B 78); Maroon Hill (B 75). No locality: A 34.

Little Inagua.—not seen.

Common on Great Inagua all year long and in nearly all open habitats, though less so in hypersaline areas. It flies low and rather slowly,

and is easily captured. In flight it resembles *Agraulis vanillae* and may be a crude mimic of it. This is one of the commonest, most widespread butterflies in the Bahamas, and its apparent absence from Little Inagua is remarkable.

Family Heliconiidae

Agraulis vanillae insularis Maynard, 1889

Agraulis insularis Maynard, 1889:89.

Agraulis vanillae insularis: Rindge, 1955:7; Clench, 1977b:275.

Dione vanillae insularis: Riley, 1975:88, pl. 9 fig. 3.

Great Inagua (i-iv, vi, ix-xii [seen all other months]).—Matthew Town (W, V, C 73, B 75, C 76, L, C 77); Airport Pond (B 78); Man of War Bay (B 75); Alfred Sound (W); Northwest Point; Stew Duck Pond (both B 78); Union Creek; Georges Hill (both B 75).

Little Inagua (iii, iv, vii).—Northwest Point (C 76, C 77); 1 mi S of Northwest Point (C 77); Southwest Point (C 76); southern coast (B 76).

Common all year long, in nearly all open habitats. Its flight is usually low and slow, and it is quite unwary. This is the most abundant and universally distributed butterfly in the Bahamas. On the southern coast of Little Inagua Bjorndal observed a female ovipositing on *Passiflora pectinata* in July. Adults on this island have been seen visiting the small white flowers of *Mallotonia* and the striking red flowers of the tree-like cactus, *Opuntia nashii*.

Family Lycaenidae

Chlorostrymon maesites maesites Herrich-Schäffer, 1864

Chlorostrymon maesites maesites: Riley, 1975:100, pl. 11 fig. 8; Clench 1977b:278.

Great Inagua.—Matthew Town, 12.vi.1976, 2 ♂ (L).

Little Inagua.—vic. Northwest Point, 14.iii, 7 ♂, 1 ♀; Southwest Point, 13.iii, 2 ♀ (both C 76).

Rare, or at least inconspicuous and local, on Great Inagua, apparently with only a brief flight period there. Mr. Campbell's two Great Inagua specimens were taken on the flowers of *Jasminum fluminense*. Most of those on Little Inagua (where its flight period is apparently different) were feeding at the flowers of *Zizyphus taylori*. This small, gem-like butterfly is easily overlooked. It spends most of its time feeding quietly at the flowers of shrubs, usually 1.5 to 2 m above the ground, and its apple-green underside color is excellent camouflage.

Strymon martialis Herrich-Schäffer, 1864

Strymon martialis: Clench, 1943:53; Riley, 1975:102, pl. 11 fig. 11; Clench, 1977b:278.

Great Inagua (ii-iv, vi, vii, xii).—Alfred Sound (W); Matthew Town (C 73); Union Creek; Spoonbill Ponds (both B 75); Flamingo Camp (B 78). No locality: A 34.

Little Inagua (iii, iv).—Northwest Point (C 76, C 77); 1 mi S of Northwest Point (C 77); Southwest Point (C 76).

In the Bahamas this species is generally uncommon and usually seen only singly. It is so on Great Inagua, but on Little Inagua it was common in March 1976—commoner than I (Clench) had ever seen it—and only a little less so in April 1977. *S. martialis* is found in scrub, on the coastal strand, and elsewhere in shrubby areas, flying and perching generally between 0.5 to 2 m above the ground. It feeds at flowers, notably those of *Suriana maritima*, *Rhachicallis americana*, and *Mallotonia gnaphalodes*. On Little Inagua it was common, particularly along the upper strand of the western coast, at the flowers of *Suriana* and especially *Mallotonia*.

***Strymon columella cybira* Hewitson, 1874**

Strymon columella cybira: Riley, 1975:104, pl. 12 fig. 4; Clench, 1977b:279.

Great Inagua (i, ii, iii, [iv, v], vi, [viii-x], xi, xii).—Matthew Town (W, C 73, C 76, B 78); Horse Pond (C 76, C 77); Airport Pond; Blakes Well (both B 78); Rocky Point; Union Creek; Stew Duck Pond (all B 75).

Little Inagua (iii, iv, vii).—Northwest Point (C 76, C 77); 1 mi S of Northwest Point (C 77); Southwest Point (C 76); southern coast (B 76).

Usually common, but fluctuates widely in numbers. It is generally distributed, especially in semi-arid scrub, usually flying 0.3 to 0.6 m above the ground, occasionally higher. It is a frequent flower visitor, particularly to low ones like *Bidens* and *Phyla*, but also to the taller *Avicennia germinans* and *Suriana maritima*. A pair was taken (Clench) at Horse Pond *in copula* at 15:27 EST, 12.iii.1976.

A female from Airport Pond, Great Inagua (21.vi.1978, Bjrndal), is aberrant. It lacks completely all the postbasal spots unhw. Occasional individuals from this island have these spots more or less reduced, but no other has been seen completely lacking them.

***Strymon limenia* Hewitson, 1868**

Strymon limenia: Riley, 1975:106, pl. 12 fig. 5.

Great Inagua.—Matthew Town (Horse Pond), 12, 13.iv.1977, 3 ♂ (Clench).

Little Inagua.—not seen.

West (1966:175) noted that a specimen of this species, labelled simply "Bahamas," is in the collection of the British Museum. The present individuals are the first with accurate localization to be recorded from the Bahamas. They were found in the company of *Strymon columella* (taken: three *limenia* to 17 *columella*), feeding at the flowers of *Phyla nodiflora* in the swales at Horse Pond. The two species were indistinguishable in the field.

***Leptotes cassius theonus* Lucas, 1857**

Leptotes cassius theonus: Clench, 1943:59; Riley, 1975:108, pl. 12 fig. 10a; Clench, 1977b: 280.

Great Inagua (ii–iv, vi, vii, xi, xii).—Matthew Town (C 73, H, C 76, C 77); Alfred Sound (W); Airport and Airport Pond (both B 78). No locality: A 34.

Little Inagua.—1 mi S Northwest Point, 9, 10.iv.1977, 1 ♂, 1 ♀ (Clench).

On Great Inagua this species is uncommon but generally distributed in shrubby areas, including town lots, flying usually 0.5–2.5 m above the ground (an unusually large range) and perching, seldom, on shrubs. Clench did not see it on Little Inagua during his visit in March 1976, and found only two in April 1977; Bjornald likewise failed to see it during her stay on the island in July 1976. Its uncommonness on both islands is noteworthy, because *L. cassius* is widespread in the Bahamas and generally common throughout, as it is elsewhere in the West Indies.

Hemiargus (Hemiargus) ceraunus ceraunus Fabricius, 1793

Hemiargus hanno filenus: Clench, 1943:56; Riley, 1975:109, pl. 12 fig. 12.

Hemiargus (Hemiargus) ceraunus ceraunus: Clench, 1977b:280.

Great Inagua (ii, iii, vi, vii, xi, xii).—Matthew Town (C 73, H, B 75, C 76, C 77, B 78); Airport (B 75); Horse Pond (C 73, C 76, B 78). No locality: A 34.

Little Inagua.—not seen.

Usually rather common, and probably flying all year, low in grassy or open scrubby areas, but apparently only in the near vicinity of Matthew Town. It has been taken at the Airport, about 2 km north of town, and at Horse Pond, about 1 km to the northeast. Strangely, Worthington did not take any in 1909.

Hemiargus (Cyclargus) thomasi [undescribed subspecies] Clench, 1941

Hemiargus catilina thomasi: Clench, 1941:407; Clench, 1943:56.

Cyclargus thomasi thomasi: Nabokov, 1945:18, pl. 3 fig. TH.TH 1.

Hemiargus thomasi thomasi: Rindge, 1955:13; Riley 1975:110, pl. 12 fig. 13 (figures represent ssp. *noeli*).

Hemiargus (Cyclargus) thomasi, subspecies: Clench, 1977b:280.

Great Inagua (i–vii, xi, xii).—Alfred Sound (W); Matthew Town (V, C 73, H, C 76, L, C 77, B 78); Airport (L, B 75); Horse Pond (C 76, B 78); Man of War Bay; Rocky Point; Union Creek; south coast; Maroon Hill; John Grey Hill (all B 75). No locality: A 34.

Little Inagua (iii, iv, vii).—Northwest Point (C 76); about 1 mi S of Northwest Point (C 77); vic. Southwest Point (C 76, B 76); southern coast (B 76); interior scrub, en route to Royal Palm Sink Holes (C 77).

Moderately common to common, mostly in areas of open scrub to dense scrub. On Little Inagua it is commonest along the coastal strand, particularly at the flowers of *Suriana* and *Mallotonia*, although a few were seen in the interior scrub. On Great Inagua it visits a variety of flowers, including those of *Avicennia*, generally flying from 0.3 to 2 m above the ground.

The populations of Great and Little Inagua are similar in appearance and represent an undescribed subspecies (Clench, manuscript).

Brephidium exilis isophthalma Herrich-Schäffer, 1862

Brephidium barbouri: Clench, 1943:58; Rindge, 1952: 13.

Brephidium exilis isophthalma: Gillham, 1955:34; Clench, 1977b:280.

Brephidium exilis barbouri: Riley, 1975:114, pl. 12 fig. 17.

Great Inagua (ii, iv, [v], vi, [vii, viii], xi, xii).—Matthew Town (Salina) (C 73, C 77); Town Salt Pans (B 78); Lighthouse Canal; Pump Station; Rocky Point (all B 75); Flamingo Camp (Long Cay) (L). No locality: A 34 (including holotype of *barbouri*).

Little Inagua (iii, iv, [vii]).—Northwest Point (salina) (C 76, C 77); southern area (large salina) (B 76 [sight]).

Variable in numbers, from quite common to seemingly absent. This little butterfly, one of the smallest in the world, inhabits salt flats, salinas, and similar hypersaline areas, associated with *Batis maritima*, *Salicornia virginica* (the probable larval foodplant), and *Sesuvium portulacastrum*. The adults feed mostly at the flowers of *Sesuvium* and *Salicornia* but have also been seen on those of *Rhachicallis americana*. The flight of *exilis* is extremely low, rarely if ever over 0.3 m above the ground, and it is quite inconspicuous. Occasional single individuals have been seen or taken on Great Inagua in the scrub or along the coastal strand, evidently strays from hypersaline areas.

Family Pieridae

Ascia (Ascia) monuste eubotea Latreille, 1819

Ascia monuste evonima: Riley, 1975:116, pl. 13 fig. 3, text fig. 13.

Ascia monuste eubotea: Clench, 1977b:273.

Great Inagua (i-iv, [v], vi, vii, xi, xii).—Matthew Town (Salina) (C 73, B 75, C 76, C 77); Town Salt Pans; Man of War Bay; Union Creek; Morton Reservoirs (all B 75); Maroon Hill (B 78); Flamingo Camp (Long Cay) (L). No locality: A 32, A 34.

Little Inagua.—not seen.

Variable in numbers, at times extremely common. It occurs mostly in areas of lush, low herbaceous vegetation bordering salinas, but may be found also in open scrub, along the coastal strand, and even in dense scrub and coppice. In 1975 its first flight began in December with the first flowering of *Cakile lanceolata*, possibly a larval foodplant locally. In May through July 1976 it was seen only near the dikes around the Morton reservoirs inland. As with so many butterflies, solitary individuals are usually wary and difficult to approach, but when numbers are large individuals seem indifferent to one's presence. A pair was taken (Clench) *in copula* 13.iv.1977, 08:40 EST, in the Salina in Matthew Town, the male flying.

This species is known to be migratory, at least on occasion, but even so it has certain regional, at least quasisubspecific divisions, as yet not carefully worked out. Inagua specimens are markedly similar to those of Hispaniola, whereas those of more northerly Bahama is-

lands closely resemble Cuban specimens. In the far northern islands (Grand Bahama, New Providence, and others) individuals are found that are like those typical of Florida.

***Phoebis sennae sennae* Linnaeus, 1758**

Phoebis sennae: Riley, 1975:134, pl. 17 fig. 1.

Phoebis sennae sennae: Clench, 1977b:273.

Great Inagua (i, ii), iii, [iv, v], vi, vii, [viii], ix–xii).—Matthew Town (C 73, B 75, C 76, C 77, B 78); Airport (L); Man of War Bay; Lighthouse; Maroon Hill (all B 75); Northwest Point (B 78).

Little Inagua ([iii]).—Royal Palm Sink Holes (C 76 [sight]).

On Great Inagua on the wing all year, but commoner in the summer months. It is seldom really common, but its bright color, large size, and high, powerful flight make it conspicuous. It is usually wary and extremely difficult to approach except when feeding at flowers. Among the flowers that it visits are *Urechites*, *Opuntia dillenii*, *Stachytarpheta*, and *Catharanthus roseus*. *P. sennae* can be found in nearly any habitat, but is more numerous in town yards, open scrub, coppice, and along coastal strands. The one individual seen on Little Inagua flew over the Royal Palm Sink Holes while we were eating lunch there.

***Phoebis agarithe antillia* Brown, 1929**

Phoebis agarithe antillia: Riley, 1975:134 (as "*antilla*") pl. 16 fig. 6; Clench, 1977b:273.

Great Inagua (iii, iv, vii, ix–xii [seen all other months]).—Matthew Town (C 73, C 77); Lighthouse; Man of War Bay (both B 75).

Little Inagua ([iii], iv).—vic. Northwest Point (C 76 [sight]); 1 mi S Northwest Point (C 77).

In general, similar in habits and habitat choice to *Phoebis sennae*, and equally difficult to approach.

***Kricogonia lyside* Godart, 1819**

Kricogonia lyside: Riley, 1975:131, pl. 13 fig. 9; Clench, 1977b:273.

Great Inagua (ii–iv, vi, vii, xi, xii [seen all other months]).—Matthew Town (W, C 73, H, C 76, C 77); Alfred Sound (W); Airport (L, B); Flamingo Camp (Long Cay) (L); Lighthouse; Man of War Bay; Rocky Point (all B 75); Union Creek (B 75, B 78); Stew Duck Pond (B 78). No locality: A 34.

Little Inagua (iii, [vii]).—Northwest Point (C 76); Southwest Point (B 76 [sight]).

On the wing all year long. It is variable in numbers but usually extremely common, probably the commonest species of butterfly on Great Inagua. Adults feed at flowers, notably those of *Avicennia*, *Rhizophora*, and *Coccoloba*. Each year on Great Inagua, in late June and July, *lyside* appears, literally by the thousands. Bjorndal saw it thus in both 1975 and 1976, and island residents said that it happens every year. Many residents have also added that these butterflies come in to

the island over the ocean from the north, and it may well be so. The species is known to migrate, at least over relatively short distances, in southern Texas and in the West Indies. It is interesting, and supportive, that the form of the species on Great Inagua is like that of the more northern islands, and distinctly different from the one prevalent on Hispaniola.

K. lyside seems to be less common by far on Little Inagua, at least during the brief spans of our few visits. Bjorndal saw one at Southwest Point in July 1976, which flew out over the ocean in the direction of Great Inagua until it was out of sight.

Eurema (Abaeis) nicippe Cramer, 1779

Eurema nicippe: Riley, 1975:130, pl. 15 fig. 7; Clench, 1977b:273.

Great Inagua.—Matthew Town, 11, 12.iii.1976, 1 ♂, 3 ♀ (Clench).

Little Inagua.—not seen.

Scarce and perhaps erratic in its appearance, the above four specimens are the only ones known from the Inaguas. They were flying about low shrubs in the northern part of Matthew Town itself. This infrequent, sporadic appearance is characteristic of *nicippe* in the Bahamas.

Eurema (Eurema) elathea elathea Cramer, 1777

Eurema elathea: Riley, 1975:123, pl. 14 fig. 6; Clench, 1977b:273.

Great Inagua (ii–iv, vi, xi, xii [seen all other months]).—Matthew Town (W, C 73, B 75, C 76, C 77, B 78); Airport (L); Horse Pond (C 76).

Little Inagua.—not seen.

Apparently flying all year and generally common. This species on Great Inagua seems to be confined to the immediate vicinity of Matthew Town, where it flies in yards and vacant lots. It is particularly common on the parade ground at the northern end of town, in spite of frequent sports events there. *E. elathea* flies low over open, often nearly bare, ground, and in open, sparse scrub. It is somewhat seasonally dimorphic—winter individuals usually have a more or less dense sprinkling of tan scales unhw, often gathered into an irregular median band. This scaling is absent in summer specimens, in which unhw is nearly pure white.

Eurema (Pyrisitia) lisa euterpe Ménétriés, 1832

Eurema lisa lisa: Riley, 1975:123, pl. 14 fig. 7.

Eurema (Pyrisitia) lisa euterpe: Clench, 1977b:274.

Great Inagua (ii–iv, vi, vii, xi, xii [seen all other months]).—Matthew Town (C 73, B 75, C 76, C 77); Airport (B 75); Airport Pond (B 78).

Little Inagua.—not seen.

Flies all year. It is only moderately frequent, but its numbers seem

to fluctuate less than is true of most other species on the island. So far as we are aware, *E. lisa* on Great Inagua is limited to the immediate vicinity of Matthew Town, and is commonest in places where green, relatively lush, grass is present. Its flight is low (0 to 0.5 m above the ground, usually 0.1 m) and rather slow. It is not wary and is easily taken.

Great Inagua specimens agree with the Hispaniolan subspecies *euterpe*.

Eurema (Pyrisitia) chamberlaini inaguae Munroe, 1950

Eurema chamberlaini chamberlaini: Bates, 1934:134.

Eurema chamberlaini inaguae Munroe, 1950:179; Rindge, 1952:7; Riley 1975:121.

Eurema chamberlaini subspecies: Clench, 1977b:274.

Great Inagua (ii–vii, ix, xi, xii [seen all other months]).—Matthew Town (W, C 73, H, C 76, L, C 77); Airport (B 75); Horse Pond (C 73, C 76, C 77); Calf Pond; Leather Fern Pond; Man of War Bay (all B 75); Union Creek (B 75, B 78); Northwest Point (B 78). No locality: A 34 (including holotype of *inaguae*).

Little Inagua (iii, iv, vii).—Northwest Point (C 76); 1 mi S of Northwest Point (C 77); en route to Royal Palm Sink Holes (B [sight]).

Flies all year. On Great Inagua it is moderately abundant, somewhat more so in summer. It flies in open scrub, dense scrub, and coppice, keeping usually below 0.5 m above the ground. It feeds at a variety of low-growing flowers including (when available) those of *Sesuvium*. On Little Inagua it is much less common and is confined to areas of relatively dense, shaded coppice and scrub near the coast.

This is one of the few endemic full species of butterflies in the Bahamas, and also one of the few butterfly species that varies racially to any considerable extent among the islands. Specimens from Great Inagua and Little Inagua seem to represent the same subspecies.

Family Papilionidae

Papilio andraemon bonhotei Sharpe, 1900

Papilio andraemon bonhotei: Riley, 1975:147, pl. 18 fig. 8 (figure represents nominate *andraemon*).

Great Inagua.—Matthew Town, 28.xi and 2.xii.1973, 1 ♂ each (Clench); 9.vi.1976, 1 ♂ (Bjorndal).

Little Inagua.—(?), see below.

Uncommon to scarce. This species resembles *P. aristodemus* on the wing, and the following sight observations cannot be referred specifically to either one. Bjorndal notes that from September to December 1975 and from May to August 1976 swallowtails were flying on Great Inagua, seen most often singly in open scrub, dense scrub, coppice, the coastal strand, and even in Matthew Town proper. On Little Inagua Clench repeatedly saw, but could not take, swallowtails in the coastal

plain coppice about 1.6 km south of Northwest Point, 7–10.iv.1977. In both instances *andraemon* is the most likely species, but it is impossible to be sure.

Great Inagua specimens have been compared carefully with *bon-hoteti* from more northern Bahama islands and there is not the slightest evidence of difference.

***Papilio aristodemus bjoerndalae* Clench, 1979**

Papilio aristodemus: Riley, 1975:146, pl. 18 fig. 7 (no mention of Bahamas; figure represents ssp. *temenes*).

Papilio aristodemus bjoerndalae Clench, 1979:275.

Great Inagua.—Calf Pond, 18.v.1976, 1 ♂ paratype; Man of War Bay, 4.x.1975, 1 ♀ holotype (both Bjoerndal).

Little Inagua.—not seen (but see comments under *Papilio andraemon*).

Apparently scarce. The above two specimens are the only ones known. Bjoerndal notes that *aristodemus* shows a marked preference for the flowers of *Plumeria obtusa* var. *obtusa*. The larval foodplant of *P. aristodemus* (ssp. *ponceanus* Schaus, 1911) in Florida is *Amyris elemifera*. This plant is common on Great Inagua, and may be the larval foodplant of *bjoerndalae* as well, but we have no definite evidence of it.

Although among the several subspecies of *aristodemus* it is nearest to *driophilus* Clench, 1979, of the more northerly Bahamas (Andros, Cat Island), *bjoerndalae* is a remarkably distinct subspecies, its characters in some ways suggesting full specific status.

Family HesperIIDae

***Epargyreus zestos inaguarum*, new subspecies**

Epargyreus zestos: Riley, 1975: 157, pl. 21 fig. 5.

Holotype.—Male, Matthew Town, Great Inagua, 13.iv.1977, *leg.* H. Clench (Sta. 387); C.M. Acc. 29106.

Paratypes.—All Great Inagua: 1 ♂, Matthew Town, 11.vi.1976, *leg.* Karen Lowell; 1 ♀, Calf Pond, 18.v.1976, *leg.* K. Bjoerndal; 1 ♂, Stew Duck Pond, 25.vi.1978, *leg.* K. Bjoerndal; and the following all Union Creek, *leg.* K. Bjoerndal: 2 ♂, 24.v; 1 ♂, 1 ♀, 3.vi; 3 ♀, 4.vi; 1 ♂, 8.vi; 1 ♂, 1 ♀, 10.vi (the preceding all 1976); 2 ♂, 1 ♀, 15.vi.1978.

Holotype and all paratypes, C.M. Ent. type series no. 695.

Description.—Differs from nominate *zestos* in the reduction in size of the hyaline spots of the diagonal median row fw. The costal spot of this row is rarely over 1 mm long, and often much less (in nominate *zestos* from Florida, usually 2.5 to 3 mm; from the more northerly Bahamas, 1.5 to 2 mm); the cell spot is usually about 1 to 1.5 times as long as wide, sometimes less (in Florida and the most northern Ba-

hamas—Grand Bahama, Great Abaco, Andros, and Eleuthera—about twice as long as wide; on Cat Island and Rum Cay, about 1.5 to 2 times); this spot is as deeply indented proximally as distally (not so in other populations), and in one extremely reduced individual the indentations are almost in contact; the spot in Cu_1 - Cu_2 is shorter and also deeply indented both proximally (not so in other populations) and distally, and the indentations may at times divide the spot in two (in one specimen the spot is nearly divided on the right side and fully divided on the left, and in several extreme specimens the spot is reduced to the anterior part only, a short linear streak lying along the base of Cu_1); the spot in anterior Cu_2 -2A is small, usually less than 1 mm across, in extreme individuals absent altogether, often rounded, and nearly always detached considerably from the one costad (in Florida the spot is large and nearly always touches or overlaps the one costad; on Grand Bahama, Great Abaco, Andros, and Eleuthera the spot is moderately large and usually touches, but rarely overlaps, the one costad; on Cat Island and Rum Cay the spot averages slightly smaller still, and is slightly detached from the one costad in most, barely overlaps in one or two). The spot in M_3 - Cu_1 is significantly reduced only in individuals that otherwise have extremely reduced spotting, and in that event may be only a minute dot, as small as, or smaller than, the inner of the three subapical dots. A curious character is that the cell spot is placed slightly more distad, so that the base of interspace M_3 - Cu_1 intrudes between it and the spot in Cu_1 - Cu_2 , true of almost all individuals examined, and much less frequent elsewhere.

Fore wing lengths of various samples are given in Table 2. As can be seen, Florida *zestos* is significantly larger than any Bahamian population, and females average about 1.2 mm larger than males. Throughout the Bahamas, including Great Inagua, sizes vary only slightly from one island to another, males averaging about 3.5 mm smaller than those of Florida (a considerable difference, with no observed overlap), and females average somewhat over 2 mm larger than their males.

Remarks.—The type locality of *zestos* given by Geyer, "Surinam," is false, but the actual source of his specimen remains uncertain. Southern Florida and the Bahamas may be ruled out because he could have had access to no material from these places. He (or Hübner, whose work Geyer continued) described a number of West Indian species from Cuban specimens (Bates, 1935:68), but *zestos* does not occur on Cuba. The only other islands in the West Indies from which Geyer or Hübner might have received material are Hispaniola and one or another of the Lesser Antilles (the type locality of *Battus polydamas xenodamas* Hübner 1825 is Martinique). It is still questionable whether or not *zestos* actually occurs on Hispaniola, but it definitely occurs in the Lesser Antilles, including Martinique (Riley, 1975:157). We have

Table 2.—Fore wing lengths (mm) of various samples of *Epargyreus zestos*.

Locality	Males			Females		
	N	Mean	SD	N	Mean	SD
<i>Epargyreus zestos zestos</i>						
Florida	13	27.12	0.62	12	28.29	1.29
Grand Bahama	9	23.61	0.65	1	26.5	—
Andros (North, South)	6	24.00	0.45	6	26.42	1.07
Cat Island	9	23.06	0.73	4	24.75	0.50
<i>Epargyreus zestos inaguarum</i>						
Great Inagua	7	22.57	1.21	6	25.08	1.39
Providenciales (Caicos)	0	—	—	3	23.67	0.65
North Caicos (Caicos Ids)	2	23.25	0.35	1	26.0	—

seen no material from Martinique itself, and so do not wish to formally restrict the type locality to that island. Riley, however, illustrates a specimen from Dominica; we have examined one from St. Lucia and another from Puerto Rico. All these agree in presenting characters, so far as can be determined, essentially as in Florida *zestos*—the hyaline spots are large, the one on the costa is long, as is the cell spot, and the one in anterior Cu_2-2A is large, triangular, and overlaps the one anterior to it.

Two other names, currently carried as synonyms of *zestos*, must be noted. The name *arsaces* Mabile, 1903, was based on a specimen from St. Thomas (Virgin Islands) and is therefore an outright synonym of *zestos*. The name *oberon* C. E. Worthington, 1881, was based on specimens from Florida (Marco Island) and is available for the populations of southern Florida and the northern Bahamas, should they ever be deemed taxonomically distinct from nominate *zestos* from Puerto Rico and south.

In addition to the type series, the following material has been seen, all referable to *inaguarum*: *Great Inagua*.—one specimen, not further localized, 15.i.1932, leg. Armour Exp., MCZ; *Little Inagua*.—Northwest Point, 10.iv.1977, 1 ♂, leg. H. Clench, CM; *Caicos Islands*.—Providenciales Id.: Erebus Hotel area (central north coast), 30, 31.i, 1.ii.1978, 3 ♀; North Caicos Id.: Kew, 4.ii.1978, 1 ♂, 1 ♀; Whitby, 11.ii.1978, 1 ♂: all leg. H. & M. Clench, CM.

At times common, perhaps chiefly in summer. Collection records on Great Inagua are for January and April–June. Bjorndal has seen it commonly in July and August, and notes that in 1976 they first appeared following heavy May rains. The species occurs most often in coppice, dense scrub, and open scrub, but has also been found in residential areas of Matthew Town. Clench saw one—now the holotype—on two mornings (12, 13.iv.1977), visiting the *Bougainvillea* flowers at The Main House. Bjorndal has observed a particular preference for the flowers of *Avicennia*.

Ephyriades brunnea [subspecies] Herrich-Schäffer, 1864

Ephyriades brunnea brunnea: Riley, 1975:175, pl. 23 fig. 1; Clench, 1977b:281.

Great Inagua (ii–iv, vi, vii, xi, xii [seen all other months]).—Matthew Town (C 73, C 77); Alfred Sound (W); Flamingo Camp (Long Cay) (L); Spoonbill Ponds; Calf Pond (all B 75); Union Creek (B 75, B 78).

Little Inagua (iii, iv, [vii]).—Northwest Point (C 76, C 77); Royal Palm Sink Holes (C 77 [sight]); en route from western coast to Royal Palm Sink Holes (C 76; B 76 [sight]; C 77).

Moderately common on both islands, and apparently on the wing all year. *E. brunnea* is most often seen in coppice, dense scrub, or open scrub, generally singly, and usually from 0.5 to 1.5 m above the ground. It seems to be particularly fond of the flowers of *Galactia* sp. (probably *spiciformis*). On Little Inagua in April 1977 a number of individuals were seen in the Royal Palm Sink Holes (the principal one), feeding at the flowers of *Psychotria* in the bottom of the sink hole—the only species of butterfly seen there at the time.

Ephyriades zephodes Hübner, 1825

Ephyriades zephodes: Riley, 1975:174, text fig. 14.

Great Inagua.—Alfred Sound, 12.ii.1909, 1 ♀ (Worthington).

Little Inagua.—not seen.

Possibly a stray from Hispaniola. The above female is the only specimen known from the island. It has been compared carefully with specimens from Hispaniola and agrees well. This individual, incidentally, was figured in Holland (1931:pl. 51 fig. 6) as *Melanthes zephodes*.

Pyrgus oileus Linnaeus, 1767

Pyrgus oileus oileus: Riley, 1975:178, pl. 23 fig. 5.

Great Inagua.—Matthew Town, 26, 30.xi.1973, 6 ♂, 3 ♀ (Clench).

Little Inagua.—not seen.

Status uncertain. At the time of his first visit to Great Inagua, Clench found this species rather common in the yards and vacant lots of Matthew Town. It had not previously been taken on Great Inagua (or anywhere else in the Bahamas), and has not been seen definitely since. Bjorndal saw a small brown and white butterfly on three occasions in 1976, but was unable to take any. They could have been *oileus*, but all these sightings were in hypersaline areas (Salt Pond Hill, Town Salt Pans), with which *oileus* is not known otherwise to associate, and none was seen close enough for a more certain identification. In April 1977 Clench looked specifically for this species in the same yards where he had taken it in 1973, but saw none.

Hylephila phyleus phyleus Drury, 1773

Hylephila phyleus: Riley, 1975:185, pl. 23 fig. 16.

Hylephila phyleus phyleus: Clench, 1977b:282.

Great Inagua (ii-iv, vi).—Matthew Town (C 76, C 77); Alfred Sound (W); Town Salt Pans; Man of War Bay (both B 75); Union Creek (B 75, B 78).

Little Inagua (iii, iv, vii).—Northwest Point (near salina) (C 76, C 77); Southwest Point (C 76); southern coast (B 76).

Uncommon and perhaps somewhat erratic in appearance. Most of the records are in the spring. Wary and fast in flight, this can be a difficult species to collect. It flies low, occurs in open, often hypersaline, areas with much bare ground, on which it often perches. Adults feed at low flowers, particularly those of *Sesuvium* and *Stachytarpheta*. It seems to be rarer on Little Inagua, and more conspicuously associated there with salinas.

Wallengrenia species

Wallengrenia druryi: Clench, 1977b:282.

Great Inagua (ii-iv, vi, xi).—Matthew Town (C 73); Airport (C 77); Alfred Sound (W); Man of War Bay (C 73, B 75); Union Creek (B 75, B 78); Town Salt Pans (B 75); Stew Duck Pond (B 78).

Little Inagua (iii, iv).—Northwest Point (C 76); 1 mi S of Northwest Point (C 77).

Uncommon and rather local. Adults occur in open scrub and dense scrub, and have been found especially at flowers of *Stachytarpheta* in small dry meadows in dense scrub. On Little Inagua it was found mostly along the upper strand, particularly at the flowers of *Mallotonia*.

This new species, soon to be described by Jacqueline Y. Miller, has been found also on Grand Turk (Turks Islands) and on Providenciales, North Caicos, Parrot Cay, and Middle Caicos (Caicos Islands).

Panoquina panoquinoides panoquinoides Skinner, 1891

Panoquina panoquinoides panoquinoides: Riley, 1975:195, pl. 24 fig. 15; Clench, 1977b:282.

Great Inagua (ii-iv, vi, [vii, viii], xi, xii).—Matthew Town (Salina) (C 73, C 76, C 77); Horse Pond (B 78); Alfred Sound (W); Pump Station; Union Creek (both B 75).

Little Inagua (iii, iv, [vii]).—Northwest Point (salina) (C 76, C 77); Southwest Point (salinas) (C 76, B 76 [sight]).

Not uncommon and probably on the wing all year long. *P. panoquinoides* is often missed, however, because it is small and inconspicuous, wary, and occurs in a habitat that is often passed by as unproductive. It is primarily an inhabitant of salinas and other hypersaline areas, frequently associated with *Brephidium exilis*. It occurs generally in clumps or stands of the grass *Sporobolus virginicus*, its probable larval foodplant. The butterfly often ranges to the borders of such areas, where it feeds at flowers, usually those of *Sesuvium*. Occasional strays may range even farther afield. Its habits and numbers are about the same on Little Inagua.

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LITERATURE CITED

- ANONYMOUS. 1976. Atlas of the Commonwealth of the Bahamas. Ministry of Education, Nassau, 48 pp. (Published by Kingston Publishers Ltd., I-A Norwood Avenue, Kingston 5, Jamaica.)
- BARBOUR, T., AND B. SHREVE. 1935. Concerning some Bahamian reptiles, with notes on the fauna. *Proc. Boston Soc. Nat. Hist.*, 40:347-366.
- BATES, M. 1934. New Lepidoptera from the Bahamas. *Occas. Papers Boston Soc. Nat. Hist.*, 8:133-138.
- . 1935. The butterflies of Cuba. *Bull. Mus. Comp. Zool.*, 78:63-258.
- CLENCH, H. K. 1941. A new race of *Hemiargus* for the Bahamas (Lepidoptera: Lycaenidae). *Mem. Soc. Cubana Hist. Nat.*, 15:407-408.
- . 1943. The Lycaenidae of the Bahama Islands (Lepidoptera, Rhopalocera). *Psyche*, 49 ("1942"):52-60.
- . 1977a. A list of the butterflies of Andros, Bahamas. *Ann. Carnegie Mus.*, 46:173-194.
- . 1977b. Butterflies of the Carnegie Museum Bahamas Expedition, 1976. *Ann. Carnegie Mus.*, 46:265-283.
- . 1979. *Papilio aristodemus* (Papilionidae) in the Bahamas. *J. Lepid. Soc.*, 32:273-276.
- FORBES, W. T. M. 1928. Variation in *Junonia lavinia* (Lepidoptera, Nymphalidae). *J. New York Ent. Soc.*, 36:305-321.
- GILLHAM, N. W. 1955. *Brephidium barboursi* Clench a synonym of *Brephidium exilis isophthalma* (Herrich-Schäffer) (Lepidoptera: Lycaenidae). *Psyche*, 62:34.

- GILLIS, W. T. 1977a. The royal palms of Little Inagua. *Bahamas Naturalist*, 2(2):26-31.
- . 1977b. Unique setting of *Roystonea* in the Bahamas. *Principes (Journal of the Palm Soc.)*, 21:109-113.
- GILLIS, W. T., G. R. PROCTOR, AND G. N. AVERY. 1975. Indigenous royal palms in the Bahamas. *Principes (Journal of the Palm Soc.)*, 19:104-105.
- HOLLAND, W. J. 1931. *The butterfly book*. New and thoroughly revised edition. Doubleday, Doran, Garden City, New York, xii + 424 pp.
- KLINGEL, G. C. 1942. *Inagua*. Robert Hale, London, 316 pp.
- MAYNARD, C. J. 1889. *Agraulis insularis* novo. *Contrib. Sci.*, 1:89-91.
- MUNROE, E. G. 1950. The dina group of the genus *Eurema* in the West Indies (Lepidoptera, Pieridae). *J. New York Ent. Soc.*, 58:172-191.
- . 1951. The genus *Junonia* in the West Indies (Lepidoptera, Nymphalidae). *Amer. Mus. Novit.*, 1498:1-16.
- NABOKOV, V. 1945. Notes on neotropical Plebejininae (Lycaenidae, Lepidoptera). *Psyche*, 52:1-61.
- RABB, G. B., AND E. B. HAYDEN, JR. 1957. The Van Voast-American Museum of Natural History Bahama Islands Expedition. Record of the expedition and general features of the islands. *Amer. Mus. Novit.*, 1836:1-53 pp.
- RILEY, N. D. 1975. *A field guide to the butterflies of the West Indies*. Collins, London, 224 pp.
- RINDGE, F. H. 1952. The butterflies of the Bahama Islands, British West Indies (Lepidoptera). *Amer. Mus. Novit.*, 1563:1-18.
- . 1955. The butterflies of the Van Voast-American Museum of Natural History Expedition to the Bahama Islands, British West Indies. *Amer. Mus. Novit.*, 1715:1-20.
- SHARPE, E. M. 1900. On a collection of butterflies from the Bahamas. *Proc. Zool. Soc. London*, pp. 197-203.
- TODD, W. E. CLYDE, AND W. W. WORTHINGTON. 1911. A contribution to the ornithology of the Bahama Islands. *Ann. Carnegie Mus.*, 7:388-464.
- TURNER, R. D. 1957. Charles Johnson Maynard and his work in Malacology. *Occas. Papers Mollusks Mus. Comp. Zool., Harvard Univ.*, 2:137-152.
- WEST, B. K. 1966. Butterflies of New Providence Island, Bahamas. *Ent. Record*, 78:174-179, 206-210.
- WITT, T. J. 1972. Beiträge zur Kenntnis der Gattung *Anaea* Hübner (1819) (Lep., Nymphalidae). *Mitt. Münchn. Ent. Ges. (e.V.)*, 62:163-183.